

WHAT IS CLAIMED AND DESIRED TO BE SECURED BY LETTERS
PATENT OF THE UNITED STATES IS:

1. A method of skew ray and residual retardation compensation in a microdisplay based device, comprising the steps of:
5 operating on light channel directed to a microdisplay with a quarter waveplate oriented such that a principle axis of the quarter waveplate is aligned parallel to an axis of linear
10 polarization of the light channel incident upon the quarter waveplate;
15 modulating the light channel after the quarter waveplate with a microdisplay oriented at an angle θ_0 such that an optical "axis" of the microdisplay is optimally oriented for residual retardation compensation with respect to the linearly polarized
light input to the microdisplay from the quarter waveplate.

2. A prism assembly, comprising:
20 a set of optics configured to break an input light beam into at least a first component light beam and a second component color light beam;
25 a first quarter wavplate inserted in the first component light beam and oriented such a principle axis of the first

quater waveplate is aligned parallel to an axis of linear polarization of the first component light beam; and

a second quarter wavplate inserted in the second component light beam and oriented such a principle axis of the second
5 quater waveplate is aligned perpendicular to an axis of linear polarization of the second component light beam.

3. The prism assembly according to Claim 2, wherein:

the set of optics is further configured to break the input
10 light beam further into at least a third component color light beam; and

the prisen assembly further comprising a third quarter wavplate inserted in the second component light beam and oriented such a principle axis of the second quater waveplate is aligned parallel to an axis of linear polarization of the second
15 component light beam.

4. The prism assembly according to Claim 3, further comprising:

20 a set of modulation devices each respectiviley inserted into a corresponding one of the component color light beams and each modulation device configured to modulate its respective corresponding component light beam;

wherein the color component light beams having parallel quarter waveplates are reflected N times after modulation and the color component light beams having perpendicular quarter waveplates are reflected M times after modulation.

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5. The prism assembly according to Claim 3, further comprising:

10 a set of modulation devices each respectively inserted into a corresponding one of the component color light beams and each modulation device configured to modulate its respective corresponding component light beam;

15 wherein the color component light beams having parallel quarter waveplates are reflected after modulation and the color component light beams having perpendicular quarter waveplates are not reflected after modulation.

6. The prism assembly according to Claim 3, further comprising:

20 a set of modulation devices each respectively inserted into a corresponding one of the component color light beams and each modulation device configured to modulate its respective corresponding component light beam;

wherein the color component light beams having perpendicular quarter waveplates are reflected after modulation

and the color component light beams having parallel quarter waveplates are reflected after modulation.

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7. A microdisplay package, comprising:

a quarter waveplate oriented such that a principle axis of the quarter waveplate is aligned parallel to reference axis; and a microdisplay device coupled to the quarter waveplate and oriented at an angle θ_0 such that an optical "axis" of the microdisplay is optimally oriented for residual retardation compensation with respect to the linearly polarized light input to the microdisplay from the quarter waveplate when the reference axis is parallel to an axis of linear polarization of light incident to the quarter waveplate.

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8. The microdisplay package according to Claim 7, wherein the quarter waveplate is cut such that outer dimensions of the quarter waveplate cover an optical face of the microdisplay.

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9. The microdisplay package according to Claim 7, wherein the quarter waveplate is cut such that outer dimensions of the quarter waveplate are congruent with an optical face of the microdisplay.

10. The microdisplay package according to Claim 7, wherein the quarter waveplate is cut such that outer dimensions of the quarter waveplate is proportional to dimensions of an optical face of the microdisplay.

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11. The microdisplay package according to Claim 7, wherein the quarter waveplates are constructed from higher order waveplates.

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12. A microdisplay package, comprising:

a microdisplay having an optical axis;

a quarter waveplate coupled to the microdisplay.

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13. The microdisplay package according to Claim 12, wherein the quarter waveplate is cut such that a principle axis of the quarter waveplate is parallel to the optical axis of the microdisplay.

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14. A microdisplay package, comprising:

A quater waveplate having a principle axis parallel of a reference axis;

a half waveplate having a principle optical axis oriented at an angle of $(1/2)\theta_0$ with respect to the reference axis; and

a microdisplay having an optical axis oriented at an angle of θ_0 with respect to the reference axis.

5 15. The microdisplay package according to Claim 14, wherein a mechanical axis of the microdisplay is at an angle of θ_0 with respect to the microdisplay optical axis.

10 16. The microdisplay package according to Claim 14, wherein a mechanical axis of the half waveplate and a mechanical axis of the microdisplay are parallel.

15 17. The microdisplay package according to Claim 14, wherein a mechanical axis of the quarter waveplate and a mechanical axis of the half waveplate, and a mechanical axis of the microdisplay are all parallel.

20 18. The microdisplay according to Claim 17, wherein the mechanical axis of the quarter waveplate is parallel to the reference axis.

25 19. The microdisplay package according to Claim 14, wherein a mechanical axis of the quarter waveplate is parallel to the reference axis.

20. The microdisplay package according to Claim 14, wherein a mechanical axis of the quarter waveplate and a mechanical axis of the half waveplate, and a mechanical axis of the microdisplay are all parallel.

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21. The microdisplay package according to Claim 14, wherein the half waveplate is cut such that a principle optical axis of the half waveplate is oriented at an angle of $(1/2)\theta_0$ with respect a mechanical axis of the half waveplate.

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22. The microdisplay package according to Claim 21, wherein a mechanical axis of the half waveplate comprises a centerline of the half waveplate.

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23. The microdisplay package according to Claim 14, wherein at least one of the quarter waveplate and the half waveplate are compensated higher order waveplates.

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24. The microdisplay package according to Claim 15, wherein at least one of the quarter waveplate and the half waveplate are compensated higher order waveplates.

25. The microdisplay package according to Claim 15,
wherein the microdisplay package is mounted on a quad style
liquid coupled kernel having at least 3 light channels.

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26. A prism assembly comprising:

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a set of optics configured to break an input light beam
into component color light beams, direct each component color
light beam to a corresponding modulation device for modulation,
and recombine the modulated component light beams into an output
beam containing an image according to an energization of the
modulation devices; and

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at least one a quarter waveplate inserted in at least one of
the component color light beams and oriented such that a
principle axis of the at least one quarter waveplate is aligned
parallel to an axis of linear polarization of the component
color light beam incident thereto;

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wherein the modulation device corresponding to the at least
one component color light beam is oriented at an angle θ_0 such
that an optical "axis" of the microdisplay is optimally oriented
for residual retardation compensation with respect to the
linearly polarized light input to the microdisplay from the
quarter waveplate.

27. A prism assembly, comprising:

optical components arranged to manage first, second, and third light channels through a portion of the prism assembly and combine the first, second, and third channels prior to exiting an output face of the prism assembly;

5 a first quarter waveplate placed in the first light channel and oriented such that a principle axis of the first quarter waveplate is aligned parallel to the axis of linearly polarized light input to the first quarter waveplate;

10 a second quarter waveplate placed in the second light channel and oriented such that a principle axis of the second quarter waveplate is aligned parallel to the axis of linearly polarized light input to the second quarter waveplate; and

15 a third quarter waveplate placed in the third light channel and oriented such that a principle axis of the third quarter waveplate is aligned perpendicular to the axis of linearly polarized light input to the third quarter waveplate.

28. The prism assembly according to Claim 27, further comprising a set of microdisplays, each microdisplay oriented 20 relative to a corresponding to one of the quarter waveplates.

29. The prism assembly according to Claim 27, further comprising:

a first microdisplay located in the first light channel in an orientation that aligns an optical axis of the first microdisplay with the axis of linearly polarized light input to the first microdisplay;

5 a second microdisplay located in the second light channel in an orientation that aligns an optical axis of the second microdisplay with the axis of linearly polarized light input to the second microdisplay; and

10 a third microdisplay located in the third light channel in an orientation that aligns an optical axis of the third microdisplay with the axis of linearly polarized light input to the third quarter waveplate.

30. The prism assembly according to Claim 28, wherein one 15 of the 1st and 2nd microdisplays is a microdisplay to be activated with a green content portion of video image data, and the microdisplay activated with the green content portion of the video image data is in the green light channel.

20 31. A prism assembly, comprising: /
at least 3 light channels;
a set of parallel waveplates and at least one perpendicular waveplate, each parallel and perpendicular waveplate

individually positioned in a respective one of the light channels;

the parallel waveplates oriented so as to have a principle axis oriented parallel to an axis of linearly polarized light
5 input to the parallel waveplates and the perpendicular waveplate is oriented with its principle axis perpendicular to an axis of linearly polarized light input to the perpendicular waveplate; and

10 at least 3 microdisplays attached to the prism assembly, each individually positioned in a respective one of the light channels and an axis of each microdisplay is parallel to an axis of polarized light input to the quarter waveplate of the same channel.

15 32. The prism assembly according to Claim 31, further comprising a $\frac{1}{2}$ waveplate positioned in a light path of at least one of the microdisplays and oriented so as to rotate an axis of linear polarization of the light path to match an optical axis of a corresponding microdisplay.

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33. A method, comprising the steps of:

placing a quarter waveplate and a half waveplate together such that a principle optical axis of the quarter waveplate is

oriented at $1/2\theta_0$ with respect to a principle optical axis of the half waveplate;

applying an linearly polarized light to one side of the bonded waveplates;

5 rotating an LCoS micordisplay at an opposite side of the bonded waveplates until a blackest possible dark state is obtained; and

securing the rotated position of the LCoS microdisplay.

10 34. The method according to Claim 33, wherein the linearly polarized light is applied such that an axis of linear polarization of the light is parallel to the principle optical axis of the quarter waveplate.

15 35. The method according to Claim 33, wherein the linearly polarized light is applied to the waveplates through a prism assembly.

20 36. The method according to Claim 35, wherein the dark state is observed at an output of the prism assembly.

37. A method, comprising the steps of: /
aligning a quarter waveplate, a half waveplate, and a microdsiplay in optical series;

applying linearly polarized light such that an axis of polarization of the linearly polarized light is parallel to a principle optical axis of the quarter waveplate;

5 observing a black state of the microdisplay; and
adjusting positions of the halfwaveplate until a blackest possible black state is obtained.

38. The method according to Claim 37, whherein said step of adjusting comprises adjusting positions of the halfwaveplate
10 the microdisplay until a blackest possible black state is obtained.